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PAPER-MAKING IN INDIA:

BEING NOTES OF A VISIT TO THE

LUCKNOW PAPER MILL.

BY

PATRICK DOYLE, C.E., F.S.S.
M. A. INST. M. E.

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PREFACE.

THE object of this reprint from the *Madras Mail* is best explained by the subjoined extract from the Editorial comment of the *Lucknow Express* on the same matter when subsequently produced in the latter journal :—

"PAPER-MAKING IN INDIA.—*The Lucknow Paper-Mill.*—The following interesting particulars on the above subject are due Mr. Pat. Doyle, C. E., M. R. A. S., a gentleman well qualified by professional knowledge and experience to discuss the same. The article subjoined is not only an exhaustive report on the local Mill, but a condensed view of the technical aspects of the industry generally, presented in an instructive and popular form."

May 1885. THE PUBLISHERS.

PAPER-MAKING IN INDIA.

The Lucknow Paper-Mill.

I.

Having had an opportunity of visiting the works of the "Upper India Couper Mill Co. (Ld.)" at Lucknow, and seen the different processes by which paper is made, I am induced to the following descriptive account of the same, under the hope that it may benefit other parts of India by influencing capitalists to launch into similar undertakings. I am all the more inclined to do so from the fact that the operations in this establishment contain much that is interesting in a comparatively new, but promising branch of industry, and that the machinery and appliances used are in accord with the latest improvements of the day.

The Lucknow Paper Mill, which claims to be the pioneer, and is, in fact, the only one of its class in Upper India, was opened early in February 1882, wher the machinery was set in motion, paper was manufactured, and the first specimens of the outturn were presented to Sir Geoger Couper, Chief Commissioner of Oudh and Lieutenant Governor of the N.-W.P., after whom the enterprise was named, in grateful recognition of the continued interest manifest- ed by him in it from its earliest inception. The initial steps date from 1879, when the Company was formed, and the capital commenced to be subscribed, the amount of which, after due consideration of the requirements of an out-put of thirty tons of paper per week, was fixed at Rs. 8,00,000, of which Rs. 5,45,000 have been subscribed. This money has been raised locally, and is the first fruits of the administrative policy of developing private enterprise in this part of the country. It has been resolved to place the remaining 2½ lakhs of debentures in the market.

The location of this factory has been advantageously fixed on the left bank of the Goomty, between the Civil Cemetery and Kookrail Nuddee, on the outskirts of the city. This site secures the desideratum of a plentiful and constant supply of water, which is so necessary for the requirements of both engine and machine, which use something like 40,000 gallons per hour. This quantity is easily obtained by a pump specially adapted

for the purpose, which is driven by means of a strap, and can be stopped and started without interfering with the Mill. The suction lift, or depth, depends, of course, upon the river level; while the height to which the water has to be raised, or forced up, is 24 feet. There are receivers in some of the highest parts of the building in which this water is stored, and from which it is distributed. These reservoirs, which are placed higher than any part of the machinery, preclude the stoppage of the Mill when the pump is deranged or under repair. The purposes for which water are most needed are in the operations of pulping and washing. It is estimated that during these operations a pound of rags must be brought in contact with one hundred times its own weight of water, which quantity has to be considerably increased, more than doubled, when the quantity used in the other processes—boiling, bleaching, and on the paper-machine—is added. The water from the Goomty is, during the greater part of the year, tolerably free from impurities, and dispenses with 'settlement,' 'filtration' and 'precipitation.' The particles suspended being very fine, and not easily deposited, is rather an advantage than otherwise; and, being chemically unobjectionable, or fairly pure, affords in itself one of the successful conditions for the manufacture of paper. Alum is the agent often employed in other places to precipitate impurities of suspended or floating matter, more specially during the rains, when river water is colored and dirty. It struck me in connection with this subject that the Indian clearing nut—*strychnos potatorum*—might be advantageously used in this department of the preliminaries of the paper factory. As far back as 1869, I brought the useful property of the nut to public notice in the columns of the *Engineer*, but I am not aware whether it has ever been turned to economic account.

The Mill building covers an area of 11,233 squarl feet, erected after designs furnished by the well known firm of Messrs. Bryan Donkin and Co., of London. It is two storied, and the construction material of the walls throughout brick. The roofing is chiefly of corrugated iron, with a portion terraced, and the general arrangement of the plan allows for two distinct sets of machinery and appliances, so that the various processes may be duplicated, and the out-turn of the Mill doubled, when occasion demands such extension of the Company's operations. By the erection of such a large building much of the available capital of the undertaking—Rs. 2,00,000—became absorbed, and has thus embarrassed it from the very start. Accommodation is also provided for the European servants of the Company

in the neighbourhood of the Mill. Compact and judicious arrangement is characterised in the fittings and fixings inside the Mill. All the machinery was supplied by the firm mentioned, and erected under the superintendence of its agents sent out from England for the purpose. The advantage, in such undertakings, of dealing with machinists who have made the manufacture of paper-making appliances a speciality is obvious; and there is no firm that has done more for this branch of British manufacturing industry than Messrs. Donkin and Co., who practically introduced the paper-machine into the United Kingdom half a century ago. They have done the same for India. The design and workmanship of their machinery in the Lucknow Paper-Mill fully sustain the reputation of the firm, for they combine the latest improvements in their appliances with the advantages of simplicity and economical working. The general principles of all paper machinery are almost identical, and whatever the material employed, the processes for nearly all have much in common among them.

Steam is the principal motor used—the engines being of a special economical type, a pair of Patent Compound Condensing, and, like everything else from Donkin in connection with this branch of industry, admirably suited for their purpose. They are 100 nominal horse-power with variable expansion, and capable of working up to very much more. The advantages claimed are simplicity in construction, comparatively little wear and tear, and economy in fuel. This last is a most important consideration, for the Bengal coal used at Lucknow costs As. 10 a maund, or about Rs. 17 a ton delivered at the mill. The boiler house contains five large Lancashire double boilers with flues 30 feet by 6 feet (diameter), which meet all the various steam requirements of the Mill. The paper-machine is worked by a motor of its own—a 16 nominal the horse-power steam engine. All the other steam power used in the mill is furnished by the pair of engines just described.

In the manufacture of paper the cost of labour is relatively much lower than in most other industries. It is asserted that fully 70 and 80 per cent. of the cost of the operation is absorbed by the machinery and materials employed. This is fully verified by the experience of the Lucknow Mill, where the total number of workmen in all departments of the factory ranges from 275 to 300 per diem. This figure represents the inclusive labor engaged during the 24 hours for 6 days in every week,

the mill working day and night. The European agency includes one mechanical engineer and four paper-makers. The whole establishment is under the superintendence of Mr. C. W. Edwards, as Manager, whose skill and exertions in overcoming the obstacles which a new undertaking had to encounter, have been handsomely acknowledged by the share-holders. It is necessary also to add that the rise and progress of the Mill is inseparably connected with the late Chairman, of the Board of Directors, Munshi Kali Prasad, whose untiring exertions in advancing the Company's interests have been attended with the best results.

But to continue with the subject of the cost of manufacture, the working expenses of the Mill aggregate Rs. 30,000 per mensem, detailed as follows :—

	Rs.
Raw materials	8,000
Fuel	5,800
Chemicals	6,700
Supervision and labor	4,000
Renewals and repairs	1,000
Insurance	400
Rail charges and carriage	1,500
Oil for machinery and lighting	500
Deterioration	1,000
Sale Agents' Commission	1,000
	30,000

The above items are constant factors in paper-making everywhere, while the figures will vary according to local circumstances conjoined with the out-put. If the vegetable fibres could be locally grown—and I can see no reason why they should not—the cost of raw materials might be reduced considerably. There is evidently room for improvement in this respect, with the present price of rags and grasses at Rs. 28 to Rs. 42 per ton. This is an anomaly with an unlimited supply of vegetable fibres in the country, and some of them very promising materials for paper-making; but very few of these have been experimented with practically on a large scale. Fuel and chemicals are the heaviest items in the working expenditure of the Lucknow Mill. The Bengal coal, which costs Rs. 3 at the pit-head, rises to Rs. 17 per

ton in transit up-country; likewise the transport of chemicals,—which include all the alkaline, bleaching, starching, sizing, and dying ingredients,—materially enhances their cost; and were it not for the utilisation of *reh* in the manner hereafter described, this charge would be very much more. Of course, if water could be delivered without pumping or utilised as motive-power, there would be a corresponding saving in machinery (first cost) and fuel (working). The railways might also do a great deal in aiding in the development of paper manufacture by lowering their charges, and thereby reducing this item. But it should not be forgotten that the mills situated at a distance from the seaboard have the advantage in trade competition of the railway freight on paper; so that these concessions operating both ways, could only result in atimulating production, and, while benefiting the railways, would eventuate in reducing generally the price of paper. Supervision and labor only cost 13⅓ per cent., of the total charges. While labor plays a very small part in cost of the operations of the Mill, it is a recognized that fact that their success depends largely upon the management. The Lucknow undertaking is fortunate in this respect, Mr. Edwards being probably the most experienced, certainly the oldest, paper-mill manager in India. The natives of Oudh take kindly to the mill-work, and soon become skilled operatives. It is work that physically suits them well. I am glad to record that the occupation is by no means as unhealthy as might be supposed from the popular notions associated with rags which consider them a source of evil or a channel for propagating disease. The other items of disbursement call for no special observation, except, perhaps, that the amount written off against deterioration is under 2 per cent. on the outlay on plant, particularised below :—

Machinery—

Preparing appliances	6,000
Paper machine	7,000
Motive power	3,500
Driving tackle	1,000
Poaching Engines, bleach pumps, &c. ...	1,000
Sundry appliances	1,000
	£19,000

Workshops—		
Fittings complete	4,000	
	£23,000	
Charges—		
Shipping and railway freight and exchange ...	11,500	
		Rs. 3,45,000
Building		... 2,00,000
Erection of machinery		... 10,000
Total, plant		Rs. 5,55,000

It will be thus seen that the cost of the plant actually exceeded the *subscribed* capital of the Company, which, with no provision for 'working expenses' nor any 'reserve' as a margin for 'contingencies,' had to commence its operations with the incubus of temporary debt. Even this negative factor might have been prevented had not some useless expenditure been incurred at the outset in the purchase of wortless appliances in Bombay, and had not so much been spent on the Mill building, the cost of which is too great by a fourth. These items are referred to here with the view of affording capitalists elsewhere *data* to show the probable requirements of like undertakings and the manner of effecting them, *pro rata*, from similar actuals. The capital invested should bear the right proportion to the value of the manufactured paper; and it is a recognized rule that the value of the products or sales of a paper-mill during one year should never be less than an amount equal to the capital invested. Instances are not uncommon of mills economically built, supplied with good machinery, and well managed, yielding sales equal to twice, and even thrice, their *bona fide* vested cost. 'Yearly sales' are only a sort of a measure of the success of a paper mill, and they in turn are more or less dependant on the kinds of paper manufactured, and the extent and constancy of the demand for the same. Here, as everywhere, this produce is sold by weight; and the selling price of Lucknow paper is from 1½ As. to 4½ As. a pound, wholesale. This would give an average rate of 3 As. per pound, or Rs. 420 a ton; but, owing to the larger quantity of cheap paper manufactured, the mean result falls somewhat lower—within the minimum limit just assigned, however, for the value of the total out-put to be taken as a criterion of prosperity. The maximum out-put

in the Lucknow Mill is 130 tons per mensem; and the quality of the products may be inferred from the awards taken at various competitions, viz., the Oudh Taluqdars' Exhibition, 1882; Amsterdam, 1883; and Calcutta, 1883-4. In this last a Certificate of Merit and Bronze Medal were received for its 'collection of papers of different kinds, chiefly for printing and packing.'

In conclusion, I am tempted to subjoin an excerpt pertinent to the interest and importance of the industry:—

'Paper has come to play such an important part in the social, intellectual, and commercial relations of mankind, that even a temporary stoppage of the supply would amount to a calamity. It is almost the only article manufactured, for which no convenient substitute could be obtained. Our woollens, linens, and cottons would stand substitute for each other; but what substance is there that would serve so many purposes as paper, or serve them so well? It is the vehicle of written thought between nations and individuals, and without it the art of printing could not have been available, except in a costly, and consequently limited way. Viewed in that light, it may be said that paper has contributed more to the advancement of the human race than any other material employed in the arts. As an article of manufacture and commerce, it occupies an important place, giving employment to many thousands of persons, and utilising materials which would otherwise be useless, or worse.'

The process of manufacture followed at Lucknow forms the subject of another article.

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The Process of Manufacture.

II.

Paper may be made from a great number of materials, all of which are of vegetable origin. The art of paper making consists in the reduction of these various products into their primitive fibres, and forming them into felted sheets. Up to a late date in Europe, rags were almost the only substance used for this purpose ; but as the consumption of paper grew with the progress of civilization other materials had to be found to satisfy the demand. These substitutes for rags in the manufacture of paper are principally straw, grasses and vegetable fibres. The materials employed for the production of paper in the Lucknow Mills are rags of all sorts ; rope and gunny (jute) refuse ; and vegetable substances, including rice-straw, 'moonj' and 'béb' or 'baib,' otherwise locally 'known as' 'khabar' or 'bankas.' The scientific name is—Major Pitcher informs me—'*Pollinia Eriopoda.*' It is found all along the Himalayas. This last plant is a sort of esparto which is collected in Shahjehanpur and Philibeet, through the Forest Department, and locally purchased at from Rs. 1 to 1½ a maund. It is said to grow at the foot, or on the lower ranges, of the hills, and as it is considered the best known raw material for paper-making in this part of India, I have sent Dr. Bidie a small bundle for the Madras Central Museum, under the belief that it, or something like it, is common in the Madras Presidency. The proved good qualities of this grass makes it desirable that it should be utilized on a much larger scale than at present. Paddy straw is by far the cheapest material, and answers the purpose fairly well. All the other substances used for the same purpose in the Mill, and already, enumerated, cost about the same price as 'béb.' It is interesting to learn that the best rags are found up-country, and that the quality deteriorates as you go down towards Bengal. This is obviously due to climatic considerations, which regulate the quality and weight of dress.

The first operation in the manufacture of paper is *sorting* the materials, and as rags and gunny form fully 60 per cent. of those used in the Lucknow Mill, my remarks will, for the most part, refer to the processes connected with these substances, which require more treatment in the

earlier stages than the grasses. This operation is done outside the building,—the object being to divide the materials according to suitability for the varieties of paper manufactured. There is no distinction made in the color of the materials, which are only classified according to fibre and texture. The red rags are sometimes set apart for making 'blotting paper,' which is not sized. Judicious intermixture is often necessary in producing particular kinds of paper. The finest rags are reserved for the best writing papers, and coarser ones for printing, while gunny and old cordage go to make packing, wrapping papers and cardings. The grasses are mixed with all. The economy in making these selections is obvious, for by working all these fibres together, subjecting them to the same mechanical and chemical treatment, the finer ones are more often destroyed by the harsh operations necessary for the reduction of the coarser. The principle is to secure for each class of fibre the treatment it requires, and no more. During this operation the rags are sometimes hand cut, or reduced when too large, and foreign substances separated from them. The usual length and width vary from 2 to 5 inches, according to the texture of the material, the coarser rags, gunny, or rope waste being required in much smaller pieces than soft cotton or other fine rags.

The next operation is *machine cutting*, or the separation of the material into still smaller pieces, to facilitate subsequent manipulations. There are three 'rag-cutters' in the Mill, worked by steampower, which is the motive in every sub-division of manufacture. Like everything else, these machines are from Donkin, and are each capable of cutting from 8 cwt. to 10 cwt. of rags, ropes, &c., per hour. The main features of their construction are fixed bed knives, paired with moving cutters, the action being comparable to that of scissors on a large scale. These blades working together, cut both length and cross wise in one operation. This double movement is said to be a speciality in the Donkin Machine, which is of a substantial pattern, and does its work without shock, and without waste of fibre. It is hand-fed.

Then follows the minor operation of *dusting*, by which the dry material is freed of extraneous matter, by agitation under quick rotary motion in an inclined box or drum covered with coarse wire netting. There is only one 'duster' in the Mill, and its construction and working calls for no further remark.

It may be well to observe, that the loss of material from waste, in the three described dry operations, ranges from 5 to 15 per cent. This is actual loss of fibres, not diminution in consequence of freedom from intermixed foreign substances. Hence this treatment of the material is not carried too far, and often partially omitted for lower grade papers.

Now commence the wet operations—the first of which is *boiling*. The object of this process is to destroy or extract the fatty, glutinous, and coloring substances surrounding the pure fibre, which is accomplished by alkalies in solution at a high temperature. The appliances used for this purpose in the Mill are six of Donkin's 'spherical rotary rag boilers,' each of which contains from 20 to 25cwt. They are of all patterns in use, those best suited for high pressure steam. The 'spherical' shape combines strength with the advantage of self-emptying. Inside the boiler are 'strainers' to take off the dirt, and 'lifters' to agitate the rags during the process of either boiling or washing, which occupies from seven to eight hours. The chemical treatment of the material during this process is simple. A mixture of lime and soda is all that is added to the contents of the boiler, for freeing the fibre from size or resinous matter. The soda employed is derived from a local product called *reh*, that saline efflorescence which is the bane of the ryot in Upper India, which has been turned to valuable account by the resource and ingenuity of Mr. C. W. Edwards, the Mill Superintendent, acting on the suggestion of Major D. G. Pitcher, Assistant Director of Agriculture and Commerce, to whom the enterprise owes much. This so called 'Sujee matte'—Fuller's earth—is collected by poor people in country places, after the same manner as earth-salt, bagged, and brought into Lucknow. It is treated within the Mill premises by being washed and caustieised in vats, to render it fit for use. The lime used in this and other processes of the Mill is obtained from Jubbulpore, C.P., which is much purer and better suited for the purpose than kunkur or the clay nodular limestone of the Province.

The material is now fit for the 'rag-engines,' or 'breakers,' under the action of which it is cut up or bruised in water till it becomes *semi-pulp*, or 'half-stuff.' This well-known apparatus consists essentially of a large cast iron cistern or trough, divided in the centre by a partition. On one side of this partition there is a revolving cylinder called the 'roll,'

the surface of which is furnished with a number of knife edges, which are so placed as to act against others fixed on a 'midfeather' or ridge on the bottom of the trough. Between these two sets of knives the rags must pass, drawn in by the 'roll' when in motion, and are cut or broken up to the extent desired. A constant stream of pure water, which is thoroughly mixed with the material under manipulation by the action of the 'roll,' flows into the cistern, while the dirty water is forced through the wire gauze which envelopes a revolving washing cylinder, in the other compartment of the cistern, called the 'drumwasher,' being drawn into a central hollow or pipe on the shaft of the cylinder by suction, whence it flows away. Thus *semi-pulping* and *washing* go on simultaneously, and, in the later stages, *bleaching*. For this latter purpose a weak solution of chloride of lime is added to the contents of the cistern. There are ten 'rag-engines' in the mill, located in the second story. These are of two classes, constructed on the same principle—'breakers' (5) and 'beaters' (5). The former, just described, reduce the material to 'half-stuff,' and the latter complete the 'pulping.' The 'breakers' are emptied by shoots into tanks built of brick and cement, on the ground floor, where the 'half-stuff' is further treated with a stronger solution of chloride of lime, in which it lies for a day or longer, according to circumstances, or the degree of *bleaching* needed, when it is drained and hoisted into the 'beaters.' In these latter (rag-engines) the bleached 'half-stuff' is further disintegrated, the fibres being reduced to the smallest practicable size, by the rapid motion of the cylinder, (the grinding tackle on the 'midfeather' and 'roll' being blunt,) making them into a thin uniform *pulp* ready for the PAPER-MACHINE.

It is at this stage of the operations that the 'pulp' from different fibres is mixed. It is said that this blending demands the exercise of knowledge and judgment, to ensure the production of paper of the sort intended. The most usual proportions in which the various fibres are used in the Lucknow Mill are: 35 parts of straw and grasses with 40 of gunny and 25 of rags. These components vary, of course, with the grade of paper wanted. Here, also, the *size* is added, by being introduced into the 'beating' machine before the 'pulp' is finished; likewise requisite *tints*. The *size* used in the Mill, and generally employed in paper-making, is a soap of resin dissolved in soda. *Starch*, though not necessary, is sometimes added, as it improves the *size*. Aluminous compounds

(*clays*, including kaolin, from which procelain is manufactured) are added at Lucknow to improve the quality, but more to increase the weight of the paper. These are cheap substances of dubious advantage, more often used under compulsion in trade competition, as they lessen the cost of the paper. The coloring materials employed in the Lucknow Mill are aniline dyes and country ochres. They are added to the 'pulp' before the 'sizing.' Alum is used as a 'mordant'; and its presence is said likewise to improve or brighten some colors.

The finished 'pulp' is emptied from the 'beaters' into two large circular receivers called 'stuff-chests,' in the 'paper-machine' room on the ground floor. By the action of agitators, the contents of these, 'stuff-chests' are kept in proper consistency, or the uniform suspension of the fibres secured. The details of the machinery and of the operations that follow are so intricate and elaborate that explanation, in the absence of illustrations, is difficult. They may be epitomised. The stuff is allowed to flow from the chests in a regulated stream, made to pass through strainers or sifters, which free it from impurities or substances other than single fibres. The pure 'pulp' on leaving the screen plates, or 'knotters,' flows equally and evenly upon an endless wire-gauze apron, which, revolving, carries on the now semi-pulp until it is received, after passing under a felt roller, on an endless sheet of felt, going round and between large couching rolls, drying cylinders, smoothing rolls, and calenders, and finally, turned out as PAPER, after travelling 334 feet. These various operations are performed by one and the same machine, called the 'FOURDRINIER,' named after the makers, who first succeeded in making it a practical success. It forms the paper; forces the water out by pressure; drys it by heating until all the remaining moisture is evaporated; and polishes the surface so as to make it true and smooth, giving the paper a glossy appearance when necessary. This invention, with its many improvements, might well, therefore, be pronounced as one of the most perfect pieces of machinery in the whole range of the industrial arts. The 'paper-machine' in the Lucknow Mill is, as already stated, Donkin's. The motive power is a small 16 H. P. Engine, used for this purpose alone. There are 14 drying cylinders, which are heated by the engines' exhaust steam under regulation. The principal calenders are polished rolls of hard cast iron known as American 'chilled.' On leaving the calenders, the

paper is wound up on *reels*. The paper becomes charged with electricity by the friction of quick travel over heated surfaces, which sometimes gives trouble and has to be got rid of by means of a sort of conductor.

The paper can be made of any width up to 90 inches, by means of moveable rubber side straps, which form a sort of mould on the wire cloth, thus retaining the stuff, and limiting the size of the sheet. The machine can turn out paper to any length at the rate of from 150 to 165 feet a minute. The whole process from the 'wire,' or wet end of the machine, to the 'reels,' does not occupy more than two minutes!

The 'reels' deliver the paper continuously to the 'cutting machine,' which is separate from the paper-making machine. The 'cutters' are small circular knives which slit the sheet into longitudinal strips, divided transversely by a cross-cut knife. The 'cutters,' being moveable along the shaft, can be adjusted at intervals equal to the width of paper required, which motion can be so regulated in unison with the cross blade as to produce sheets, square and correct, of the length desired, as fast as they can be received by the attendants. While this is being done, defective sheets are cast aside, and the good ones stacked in piles. These piles are removed to the paper-room or '*Soll*,' where the sheets are sorted, counted, and packed, ready for despatch. It is in this part of the building that the capabilities of the Mill can be fully gauged. The paper of this manuscript is the Mill product. The out-turn includes several kinds of paper, coarse and fine, white and colored. The quantity manufactured averages 125 tons a month—composed principally of 'printing,' 'machine-writing,' colored, in great variety, half bleached or 'badami,' 'brown-packing,' and 'cartridge.' Some of these papers have 'water-lines;' and special 'marks' are applied to them—which is done at the wet end of the 'paper-machine'—if wanted on large orders. I may mention that the Local Governments of the North-West Provinces and Oudh, and of the Punjab use the paper here manufactured largely; and some of it is taken by the Cabul Government. The native demand for the inferior papers is large, and in order to meet this and other growing demands, official and private, the Company is gradually extending its operations.

N. B.—This Pamphlet is printed on the Lucknow Mill Paper.

APPENDIX.

THE CONSUMPTION OF PAPER.—There are 3,985 paper mills in the world, in which 1,904,000,000 pounds of paper are annually manufactured. Half of this paper is used for printing, 600,000,000 pounds only for newspapers, the consumption of which has risen by 200,000,000 pounds during the last ten years. As to the use of paper by individuals, an averge of 11½ pounds is used by an Englishman, 10½ pounds by an American, 8 pounds by a German, 7½ pounds by a Frenchman, 3½ pounds by an Italian or Austrian, 1½ pounds by a Spaniard, 1 pound by a Russian and 2 pounds by a Mexican.

THE PAPER PRODUCTION OF INDIA.—There are at present seven paper mills in this country: three of three of these are in the Bombay Presidency, one at Bally near Calcutta, one at Lucknow, one at Gwalior, and another at Titaghur. The last named, however, only began working during the past year. By far the largest outturn in 1883 was form the Bally Mill, which produced 5,447,680lbs. of paper, valued at Rs. 6,00,000. Next to this came the Gwalior Mill, which made 1,048,320lbs. of paper, valued at Rs. 1,08,125. Most of the paper made in India is of the coarser kinds, and there is still considerable room for improvement in the better qualities.—*Bangalore Spectator.*

PUBLIC OPINION ON THE LUCKNOW PAPER MILL.—The Shareholders of the Paper Mill are to be congratulated on the satisfactory condition of their affairs and the prospects in store for their enterprise. This is mainly due to the exertions of the present Managing Agent, Munshi Kali Prasad, which we are glad to see properly and suitably acknowledged. Mr. Edwards, the Mill Superintendent, deserves all the credit he gets.—*Lucknow Express.*

REDUCED RATES OF CARRIAGE ON MATERIALS FOR PAPER-MAKING.—The Railways have now generally agreed to reduce their prevailing charges for carrying fibres or fibrous materials destined for the manufacture of paper, provided the said materials are tendered in compressed bales, so as to give suitable waggon loads, and reduce the difficulty of loading and unloading. The Oudh and Rohilcund Railway's special concession in this respect to the Lucknow Mill is the reduced rate of 3½ annas per 10-ton wagon per mile, which is equivalent to a saving of something like 40 per cent. on the previous charge.

VALUE OF IMPORTS OF PAPER INTO INDIA.—The orders issued by the Government of India in 1881, directing that country made papers should, as far as possible, be used in all Government Offices instead of the imported articles, have attracted public attention to the development of the paper-making industry in the country. The extent of this greater activity may be guaged by the fact that the value of the total imports of paper by sea fell from Rs. 56,48,066 in 1880-81 to Rs. 44,50,804 in 1882-83. These figures not only show the growth of the paper industry in India, but the extent to which local manufacture still falls short of requirements. During the period mentioned the Government requisition on imported Stationery Stores ranged in value from 6½ to 11 lakhs of rupees per annum.

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